Explaining Agricultural Commodity Price Increases: The Role of Biofuel Policies

Harry de Gorter
Department of Applied Economics and Management
Cornell University

1. Introduction

Agricultural commodity prices have increased sharply since 2002 and especially in the past two years when grains and oilseeds prices doubled. The IMF's index of internationally traded food commodities prices increased 130 percent from January 2002 to June 2008 and 56 percent from January 2007 to June 2008 (see Mitchell 2008 and Figure 1). Historically, real commodity prices have declined while nominal prices have increased. In the recent past, however, Figure 1 shows that both real and nominal prices have increased in lock-step. The increase in food commodities prices was led by cereals (Figure 2). From January 2005 until June 2008, maize prices almost tripled, wheat prices increased 127 percent and rice prices increased 170 percent (Mitchell 2008). The increase in grain prices was followed by increases in fats and oils prices in mid-2006 with palm oil prices up 200 percent from January 2005 until June 2008, soybean oil prices up 192 percent, and other vegetable oils prices increasing by similar amounts (Mitchell 2008). Meat prices have yet to increase substantially but inevitably will as animal inventories decline with soaring feed costs.

Many factors have contributed to these higher commodity prices. One can categorize these factors as follows: (1) macroeconomic forces like declining U.S. $ exchange rates and real interest rates, the latter leading to a wave of speculation in commodity markets; (2) higher oil prices increasing input costs and demand for biofuels; (3) changes in fundamentals of the underlying supply/demand situation such as income growth, especially in Asia, and lower supply growth because of neglect in agricultural R&D expenditures; (4) supply shocks due to bad weather and crop disease; (5) failure to reform current agricultural policies while rising prices have led to policy actions in the short run such as export taxes and bans as well as reduced tariffs on commodity imports; and (6) biofuel policies.

Clearly each category is interdependent to some extent but the purpose of this paper is twofold: first, to examine the contribution of the various factors identified above behind the rapid increase in agricultural commodity prices since 2002; and second, to speculate as to how prices will change in the next ten years. This paper emphasizes the central role of biofuels in causing the recent spike in commodity prices and is very sympathetic to the framework of analysis and conclusions of Mitchell (2008, p. 1):

"Without the increases in biofuel production in the United States and European Union, global wheat and maize stocks would not have declined appreciably, oilseed prices would not have tripled, and price increases due to other factors, such as droughts, would have been more moderate. Recent export bans and speculative activities would probably not have occurred because they were largely responses to rising prices."

One hypothesis is that stocks were drawn down over time and only one shock was needed to trip price increases. The effect of biofuel policies was triggered by the recent spike in oil prices, thereby precipitating the current commodity price increase. However, many other factors were at work. Before looking closely at the role of biofuels in increasing commodity prices, the paper first briefly assesses the importance of each of the other explanatory factors.

2. Macroeconomic Developments

One key explanation for the commodity price spike is the decline of the dollar, and the increased investment in commodities by institutional investors to hedge against inflation and to diversify their portfolios. The extent to which these have been significant factors is difficult to assess. Although the U.S. dollar depreciated about 35 percent against the euro from January 2002 to June 2008, the trade-weighted real exchange rate for U.S. bulk agricultural exports computed by the USDA depreciated only 26 percent during that period (Mitchell 2008). Figure 3 shows that corn prices remained flat between 2002 and 2006 while the euro increased continually against the U.S. dollar. However, statistical analysis has shown that the depreciation of the dollar increases dollar commodity prices on average with an elasticity between 0.5 and 1.0 (Gilbert 1989; Baffes 1997). Using an elasticity of 0.75, about 15 percent of the recent increase in agricultural commodity prices can be attributed to the decline of the U.S. dollar (Mitchell 2008).

Speculative and investor activity has also increased and can contribute to short run commodity price increases as a low real interest rate reduces the cost of storage and investors shift into real commodities as a hedge against inflation and to diversify portfolios. The portfolio balance model has demand for inventory with a speculative and a convenience yield component, both of which are a function of the interest rate, spot and expected prices, and storage costs. Even with fairly inelastic supply and demand, any large speculative deviation from the “fundamental” price should show up in noticeable increases in inventories. Mitchell (2008) concludes the impact on prices is hard to quantify and most studies do not find that such activity changes prices from the levels that otherwise would have prevailed. It should be noted that the relationship between exchange rates and commodity prices depend in part on the source of the change in exchange rates. It matters if inflation *versus* economic growth *versus* interest rate changes is the major driver of exchange rate changes. Abbott et al. (2008) put a larger weight on macroeconomic factors affecting agricultural commodity prices relative to supply/demand fundamentals. Either way, speculative activity likely has short run effects and thereby affect the rate of adjustment to a new equilibrium with a change in fundamentals.

3. Higher Oil Prices

The increase in oil prices and the related increases in prices of fertilizer, chemicals and transportation have increased the cost of production, which ultimately gets reflected in higher commodity prices. Baffes (2007) estimates that grain prices increase 0.18 percent for every one percent increase in the price of oil. Given that oil prices have at least tripled in the past two years, this would suggest an increase of 36 percent in crop prices on average due to higher oil prices. Mitchell (2008), on the other hand, estimates that oil prices have contributed about 12-15 percent to higher U.S. food commodities production and transport costs. Higher oil prices also provided an impetus for the production of biofuels and instigated political support for biofuels production. This we will turn to later in the paper.

4. Fundamental Change in Agricultural Supply and Demand

Figure 4 shows the growth rates in grain and soybean consumption (total *versus* feed) in East Asia. The growth rates have if anything declined in recent decades and so expeditious income growth in Asia has not led to large increases in global grain consumption and so were not accountable for the large rise in grain prices. However, it has contributed to increased oilseed demand and higher oilseed prices as China increased soybean imports for its livestock and poultry industry. Both China and India have been net grain exporters since 2000, although exports have declined as consumption has increased (Mitchell 2008). In fact, China has been a net meat exporter for the last 7 years and 14 of the last 18 years (Ray 2008). Global consumption of wheat and rice grew less than 1% per year from 2000-07 while maize consumption grew 2.1% (excluding U.S. ethanol). Global grain feed use grew 1.3% from 2000-07, less than the previous decade due to slowing population growth and low income elasticities (Mitchell 2008).

Because of a slow drawdown in stocks in this past decade, one could argue supply has not been keeping up (Abbott et al. 2008). Commentators have been emphasizing the neglect of investment in new technologies for agriculture and restrictions on the use of biotech innovations (IFPRI 2008; Abbott et al. 2008). Figure 5 shows growth rates of yields are slowing in developing countries.

5. Supply Shocks

Weather-related production shortfalls have been identified as a major factor underpinning world cereals prices (OECD-FAO 2008; Collins 2008; Abbott et al. 2008). As explained in detail by Mitchell (2008), consecutive droughts in Australia reduced grain exports by an average of 9.2 million tons per year compared with 2005, and poor crops in the EU and Ukraine reduced their exports by an additional 10 million tons in 2007. However, these declines were more than offset by large crops in other exporting countries. Total grain exports from these countries in 2007 increased by about 22 million tons compared with 2006. Global grain production did decline by 1.3 percent in 2006 but it then increased 4.7 percent in 2007. Thus the drop in production in grains would not, by itself, have been a major reason for the increase in grain prices. But when taken together with large increases in biofuels production, land use changes, and stock declines, production shortfalls were inevitably a factor in the price rise. The reduced production due to bad weather was most significant in wheat, where global production declined 4.5 percent in 2006 and then increased only 2 percent in 2007. Global oilseed production rose 5.4 percent in 2006/07 and declined 3.4 percent in 2007/08 (Mitchell 2008).

6. Agricultural Policy Changes

Figure 6 provides data on the number of countries reacting to the price increases, further exacerbating the world price increase. About 22 to 32 countries controlled or subsidized food prices, decreased taxes, decreased import tariffs or imposed export measures. Each of these policy reactions fueled the price increases by either restricting access to supplies (as in the case of export bans or taxes) or increased demand for the product more than otherwise (as with the other three categories of measures). Note that as each country employed these measures, the initial benefit of one country is canceled as the world prices increased as a result of all countries doing the same thing. Ultimately, the outcome was self-defeating and made it worse for all consuming countries.

The impact of these bans or restrictions is exemplified by how Thailand's rice export price skyrocketed after India banned rice exports in October, 2007. As documented by Mitchell (2008), there were no other important changes in market conditions at that time that could explain the ensuing rice price increases. While not all of the price increases were due to the ban, it inevitably induced governments to monitor markets and the increased wheat prices in particular may have induced politicians to pass laws that increased imports and reduced exports, thereby exacerbating the rise in rice prices.

Rice is not a feedstock for biofuels, but the increase in prices of other commodities contributed to the rapid rise in rice prices. Rice prices almost tripled from January to April 2008 despite little change in production or stocks (Mitchell 2008). This increase was mostly in response to the spike in wheat prices in 2007 (up 88 percent from January to December) which raised concerns about low global grain supplies and encouraged several countries to ban rice exports to protect consumers from international price increases, and caused others to increase imports.

7. The Role of Biofuel Policies

The increase in biofuels production (especially in the United States and European Union but also in Canada and other rich countries) has not only increased demand for food commodities, but also led to large land use changes which reduced supplies of wheat and crops that compete with food commodities used for biofuels.

Without a complex web of U.S. biofuel policies with subsidies stacked upon one another, no ethanol or biodiesel would be produced in the United States. The same thing can be said about biofuel production in the European Union, Canada and other rich countries. Brazil, on the other hand, would be the least cost supplier of ethanol and the lowest cost biodiesel is from palm oil produced in Asia. Hence, most of current U.S. and EU biofuel production is due to deliberate government policies: tax credits and mandates (policies by themselves that do not discriminate against trade); import tariffs and quotas; production subsidies for biofuel feedstocks and biofuels; and sustainability thresholds.[1,2]

Figure 7 shows the share of the increase in global maize consumption each year since 2004 that went for U.S. ethanol. The 2008 number is the USDA's August 12th estimate released at the same time as their new crop production estimate. U.S. ethanol is projected to take 95.2% of the increase in global maize consumption in 2008, and all other uses (food, feed, seed, and other industrial uses) will account for only 4.8 percent. In 2006 and 2007, U.S. ethanol accounted for 62.5 and 57.3 percent of the increase in global consumption.

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[1] For example, the United States (European Union) has unilaterally required a minimum 20 (35) percent improvement in GHG life-cycle improvement for corn-ethanol (biodiesel).

[2] We ignore other policy categories like subsidies for R&D of new technologies and policies that reduce biofuel production because they shift the demand curve for non-biofuel feedstocks right (e.g., U.S. import quota on sugar increases the demand for corn used as a sweetener product), or the supply curve for biofuel feedstocks left (e.g., U.S. subsidies for other crops). Sugar policies divert corn from ethanol to corn syrup (while reducing the world price of sugar and hence reduce import prices of ethanol from Brazil) while subsidies to other field crops diverts land from corn production.

Figure 8 shows the relatively rapid increase in rapeseed and sunflower area (used mostly for biodiesel) compared to wheat relative to 2001 (index). These crops are competing directly with wheat and have kept wheat area from expanding. The production potential of this land was 20-25 million tons in 2005-2007 and is projected to be 41 million tons in 2008. If this land had went into wheat instead of rapeseed and sunflower, it would have allowed wheat stocks to rise instead of falling sharply as actually occurred (labeled as actual and potential wheat stocks in Figure 9).

In addition to the contribution of various factors such as the declining U.S. exchange rate and the increase in production costs due to higher oil prices, the empirical evidence is such that the large increase in U.S. and EU biofuels production has been a major contributor to commodity price increases. Grain stocks would not have decreased as much as it did nor would oilseed prices have increased as a consequence. The effects of bad weather would have had less of an impact on prices and the ensuing export bans and speculative activities are directly a result of rising prices in the first place. So it is important to understand the basics of how biofuel policies work.

Economists have underestimated the impact of biofuel policies and the easiest way to show this is by first looking at the effects of a tax credit.[3]

The market price for ethanol P_E is given by:

(1) $$P_E = \lambda(P_G + t) - t + t_C$$

where λ is the ratio of miles per gallon of ethanol relative to gasoline and is approximately 0.70, P_G is the price of oil-based gasoline, t denotes the *volumetric* fuel tax and t_C is the tax credit for ethanol. To take advantage of the government subsidy offered them, blenders of ethanol and

[3] The derivation of the results explained in this section is developed in several papers by de Gorter and Just listed in the references below.

gasoline will bid up the price of ethanol until it is above the market price of gasoline by the amount of the tax credit (57 cents per gallon if we include state tax credits).

The first term on the right hand side of equation (1) is the price consumers are willing to pay for ethanol. The middle term in equation (1) shows how blenders have to pay the full tax t but consumers are only willing to pay λt. Hence, the difference $(1- \lambda)t$ is a penalty on ethanol production. The tax t is a disproportionate tax on ethanol because it is levied on a volume basis while demand is on a mileage basis.

Several important conclusions can be made. Increasing the fuel tax reduces the market price for ethanol while the opposite occurs with a tax credit. The market price will be determined by the country with the lowest fuel tax and highest tax credit (which is the United States for both ethanol and biodiesel as taxes are low and tax credits are high (e.g., $1.01/gal. for biodiesel)). Note that domestic and foreign producers of ethanol benefit alike from this tax credit.

Another implication of equation (1) is that there should always be a tax credit equal to the penalty to keep a distortion free market. Instead of subsidizing ethanol production, countries are often taxing ethanol if fuel taxes are high relative to tax credits (e.g., a $5/gal. tax in the UK translates into a $1.50/gal. penalty on ethanol). Such is the case in Brazil were the penalty is higher than the tax credit in every state except Sao Paulo.

But the situation is even more complex. The formula for the market price of ethanol given in equation (1) above predicts U.S. ethanol prices very accurately but over-predicts ethanol prices in Brazil and Canada. This is because the market price of ethanol in Brazil equals the U.S. market price less tariffs and transportation costs (while Canada does not face ethanol tariffs due to NAFTA). The net positive tax credit in the state of Sao Paulo therefore does not bid up the price of ethanol but constitutes a production subsidy for ethanol, causing an increase in the price of sugar instead. In Canada, market prices for both corn and ethanol are unaffected by Canadian ethanol production so the tax credit serves as a subsidy for ethanol producers only.[4]

The Link between the Corn and Ethanol Markets

Now that we have established how ethanol prices are determined in relation to a tax credit, the big question now becomes: how does that affect the corn price? The formula for the change in corn prices is as follows:

$$(2) \qquad \Delta P_{CORN} = \left(\frac{\beta}{1-\delta}\right) t_C$$

where β denotes the gallons of ethanol produced from one bushel of corn (2.8) and δ denotes the proportion of the value of corn returned to the market in the form of by-products (0.31). The resulting value of $\beta/(1 - \delta)$ is 4.06. This means the corn price is very sensitive to a change in the price of ethanol (induced by either a change in the tax credit or world oil price). A tax credit of 57¢/gallon translates into approximately a $2.31 per bushel increase in the price of corn. The intuition for why one divides β by $(1 - \delta)$ in equation (2) is that as the value of the by-product increases, the benefits of a tax credit also increases as ethanol producers are willing to pay more for corn.

From Table 1 below, the contribution of the tax credit to corn prices ranges from 39–87 percent, depending on base values and current corn prices. The same outcome occurs if a consumption mandate is used instead to generate the same price premium. At $6/bushel corn, Abbott et al. (2008) attribute 25 percent of the price increase to biofuels. Our data in Table 1 indicates it would be 58–63 percent, depending on the base price used. Other studies however obtain much lower estimates. Elobeid and Togkoz (2008) conclude that biofuel policy adds

[4] As of April 2008, Canada has converted biofuel tax credits into biofuel production subsidies. In theory, this makes no difference to the market.

$0.05/bushel to the corn price while FAPRI (2008) assigns a $0.14/bushel price increase due to biofuels. The only economists to use the formula in equation (2) are Collins (2008) and Mitchell (2008), thereby attributing a higher share of the commodity price increase to biofuel policy compared to other studies.

Table 1: Share of Increase in Corn Price due to Tax Credit

	Base Corn Price	
	2006	1982-2007
	$2/bu	*$2.35/bu*
Corn prices		
$5/bu	0.77	0.87
$6/bu	0.58	0.63
$7/bu	0.46	0.50
$8/bu	0.39	0.41

Some argue that increased biofuel production reduces oil prices and so the effect on corn prices is not so high. This ignores the fact that there is only a 20 percent net energy savings with biofuel production according to life-cycle accounting by Farrell et al. (2006) and that biofuels as a percent of total world oil consumption is less than one percent and constitutes an even smaller share of total world primary energy consumption. Furthermore, OPEC maybe reacting in a way to counter the price decreasing effect of biofuels on oil prices.

The analysis so far ignores the billions of dollars in corn subsidies and in subsidies for the production of biofuels (Koplow 2007) that also provides a life line to biofuel production in developed countries. Furthermore, elimination of import tariffs and import quotas would reduce ethanol and corn prices even more.

To assess the impact of ethanol policies in the past, Figure 10 presents three price series: the actual ethanol price, the ethanol price if there was only the tax credit (given by equation (1)), and the price of ethanol if there was no policy nor additive value for ethanol. There are several important conclusions when analyzing this historical experience in the United States. First, the price premium for ethanol over gasoline has exceeded the tax credit in the past 25 years. This is shown in Figure 10 where the actual ethanol price is higher than the price that otherwise would be if only a tax credit affected ethanol prices and consumers purchased ethanol only for its contribution to mileage. This means that because the actual ethanol price in Figure 10 is above the predicted price of ethanol if only the tax credit was operational, the tax credit was dormant in past years.[5] An explanation for why the ethanol price premium was above the tax credit in the past is that ethanol was purchased historically because of *de facto* mandates in the form of environmental regulations (the Clean Air Act of the 1990s or the implicit ban in MTBE in this decade) or for its additive value as an oxygenate/octane enhancer. The result was price premium above that if only a tax credit was operational.[6]

Historically, the implied increase in the corn price of $2.31/bushel due to the tax credit was often greater than the market price of corn itself. The only way this could occur is either gasoline prices were extremely low, the costs of ethanol production very high or the opportunity cost of corn in non-ethanol use very high. This means the intercept of the ethanol supply curve was far above the price of oil. This 'water' in the tax credit means the taxpayer costs were mostly wasted in 'rectangular' deadweight costs – no transfers were made to any group in society. Hence, farmers historically have not been able to take advantage of such a large subsidy implied by the tax credit because a significant part of the tax credit was redundant.[7]

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[5] Well, not necessarily – it likely was subsidizing oil consumption – see de Gorter and Just (2007a).

[6] More recently, the tax credit is binding but the expanded federal mandate in the form of the Renewable Fuel Standard in recent energy legislation (in conjunction with continuing local and state mandates) may result in an ethanol price premium above the tax credit again in the future.

[7] Indeed, the intercept of the ethanol supply curve in the United States has been approximately $100/barrel. In other words, unless oil prices are $100 per barrel or higher, there would be no ethanol production in the United States without either biofuel policies (including subsidies and tariffs) or corn subsidies. Tax credits and mandates by themselves would have generated little if no ethanol production. Tax credits therefore had minimal impacts on corn prices at low levels of oil prices.

Consider Figure 11 where the supply of ethanol $S_{Ethanol}$ is derived from the horizontal difference between the supply of corn S_{Corn} and non-ethanol (domestic and export) demand for corn D_{NE}. The intersection of $S_{Ethanol}$ and D_{NE} defines the intercept of the ethanol supply curve, denoted by the price of corn P_{NE} that would occur if there was no ethanol production. Because the gasoline price in \$/bushel P_{GASb} is less than P_{NE}, there would be no ethanol production without the tax credit. The distance between corn production Q_{Corn} and non-ethanol consumption C_{NE} is corn devoted to ethanol (adjusted for by-product value not shown). Taxpayer costs of the tax credit are given by the production of ethanol times the tax credit (where the tax credit = $\beta/(1 - \delta)]t_C]$. Because of water in the tax credit, part of the tax cost is rectangular deadweight cost given by the shaded area.

Not only was the intercept of ethanol supply above the price of gasoline, but also was above the price of corn. The only way this can happen is with production subsidies for corn and/or ethanol. These subsidies are the only reason for ethanol production in these cases. In other words, even with the tax credit or ethanol price premiums due to additive value, there would be no ethanol production unless there were production subsidies for corn and/or ethanol as well.

Only when oil prices shot up in the last couple of years did the tax credits have a measurable impact on corn prices. With higher oil prices, the gap between oil prices and the intercept of the ethanol supply curve narrowed. The tax credit then had a larger impact on corn prices. If the oil prices are above the ethanol supply curve intercept, then the tax credit has a full impact on corn prices. Because the per unit tax credits are fixed, a spike in oil prices will lead to a spike in corn prices (with a lag because it took some time to get ethanol processing facilities online). Clearly then, fixed per unit tax credits in the face of oil price spikes causes instability in the corn market. Because the corn market is linked to other markets through substitution in both demand and for land in supply, this price spike in corn markets is quickly transmitted to other crop prices. This is partially responsible for the current food crisis. But mandates are more likely to transmit instability to the corn market for shocks originating in the supply or demand for corn. It is better to have a mandate conditional on the price of corn than a tax credit conditional on the price of oil.

So recent biofuel developments were a confluence of forces including a combination of two key government policy changes: the Renewable Fuel Standard (RFS) of 7.5 billion gallons by 2012 and the *de facto* ban on MTBE, a substitute for ethanol as a fuel additive. Ethanol prices spiked while corn prices stayed low. Once ethanol production surpassed the infra-marginal amount of ethanol required as an additive, ethanol prices plummeted (the *de facto* mandate was gone and the RFS of 2005 surpassed and so was never binding). In the meantime, oil prices spiked. This led to a spike in corn prices because of the fixed tax credit increased demand while production costs increased and corn supply declined. Meanwhile, plans for a major new RFS finalized December of 2007, emboldening more ethanol production facilities to be built. After 2006, a link between the corn, ethanol and oil price was forged through the tax credit (plus import tariffs/quota; biofuel production subsidies). Instability from the oil market was transmitted to the corn market with biofuel policies the link. If a blend mandate was used instead, then instability from the oil market would not have been passed on to the corn market.

8. Commodity Price Forecasts

There are many institutions that forecast commodity prices including IFPRI, FAPRI, USDA and the OECD-FAO. This paper summarizes only the latter's outlook. The OECD-FAO (2008) undertake their forecast in an environment of increased instability in financial markets, higher commodity prices, signs of slowing global economic growth and food security concerns.

Although world prices are currently at record levels, some of the factors behind the recent price hikes are deemed to be transitory. For example, supply shocks from bad weather and crop disease, speculative activities in commodity markets due to monetary shock with low real interest rates and recent policy actions in the form of export controls are all surely short run in nature and will be overcome with a supply response and a settling down of commodity markets. However, there are a few medium term developments that may prevent, for the foreseeable future at least, commodity prices to continue their long term decline in real terms. These are higher oil prices, biofuel policies and the cumulative effect of neglecting investment research and new technologies for agricultural production in the past three decades. Because land is becoming increasingly scarce (although Brazil and Russia have millions of hectares of land available for crop production), most future increases in agricultural production will have to come from increases in yield per hectare (IFPRI 2008; Abbott et al. 2008). Reform of agricultural policies in the Doha Round and an improvement in the U.S macroeconomic picture would also help stabilize world commodity prices but no signs of reform in these two important areas are evident as of now. This paper showed that growing world incomes are not as a significant factor in the recent price rise as many other commentators have argued. Although changing diets, urbanization, economic growth and expanding populations are increasing food and feed demand in emerging markets, we showed that the recent increase in biofuel demand is the largest source of new demand and therefore the biggest factor contributing to the recent spike in agricultural commodity prices.

The OECD-FAO (2008) forecast in the medium term predicts commodity prices to average substantially above the levels that prevailed in the past 10 years. When the average for 2008 to 2017 is compared with that over 1998 to 2007, beef and pork prices may be some 20%

higher; raw and white sugar around 30%; wheat, maize and skim milk powder 40 to 60%; butter and oilseeds more than 60% and vegetable oils over 80% (see Figure 12). The OECD-FAO (2008) does however predict that prices will resume their decline in real terms, albeit at a slower rate, and will differ across commodities. In addition, prices are also predicted to be more volatile because of the diminished stock levels that will take time to be restored, a more inelastic demand at the farm level because of the farmer's lower share of retail food expenditures, and weather conditions deteriorating because of global warming.

9. Concluding Remarks

In summary, the increase in agricultural commodity prices was caused by a convergence of factors, but one of the most important was the large increase in biofuels production from grains and oilseeds in the United States and Europe Union. Without these increases, the sharp drawdown in global grain stocks may not have transpired. As a consequence, expansion of wheat production was limited because of the land use changes in response to increased oilseeds plantings for biodiesel. The large increase in rice prices was largely a response to the increase in wheat prices rather than to changes in rice production or stocks, and was thus indirectly related to the increase in biofuels. Reduced exports because of bad weather would normally have been offset by other exporters. Recent export bans on grains and speculative activity would probably not have occurred without the large price increases due to biofuels production because they were largely responses to rising prices (Mitchell 2008). Higher oil prices in raising production and transportation costs and the falling U.S. dollar contributed significantly to the recent price increase (about 27–30 percent according to Mitchell 2008).

This paper argues that the most important factor precipitating short run price increases was biofuel policies, estimated to increase corn prices by 39–87 percent, depending on current corn prices and base levels. The unexpected spike in oil prices triggered the effects of the tax credit on the corn market (while mandates emboldened ethanol producers to expand capacity). Previously, there as too much "water' in the tax credit for the tax credit to have a big impact on corn prices. This was all unexpected and unknown at the time. The commodity markets were unable to respond in the short run. Hence, the important roles of biofuel policy in the commodity price rise. This all occurred in the face of deliberate policies (subsidies, tariffs) that discriminated against imports of low cost sugarcane ethanol from developing countries.[8] The spike in grains prices would not have occurred if ethanol was allowed to be imported from Brazil instead. Sugar is not a staple food and biofuel production from sugar cane in Brazil is lower-cost than biofuels production in the United States or the European Union. Ethanol production in Brazil has not raised sugar prices very much because supply conditions are such in Brazil that sugar cane production was able to respond in the short run to satisfy the increased demand for sugar and ethanol.

Future commodity prices will depend on the supply response, especially from Brazil and the former Soviet Union where most of the land available for increased agricultural production currently resides. The outcome will also depend on biofuels policies, as the European Union currently appears to be carefully re-assessing their policies (Gallagher Review 2008). Technological developments to increase agricultural productivity are also key to the future as recent high prices may induce farmers to adopt higher yielding varieties while enabling companies to invest more to improve them. Perhaps the recent price spike will also persuade governments to relax restrictions on biotechnologies and expand public support for new

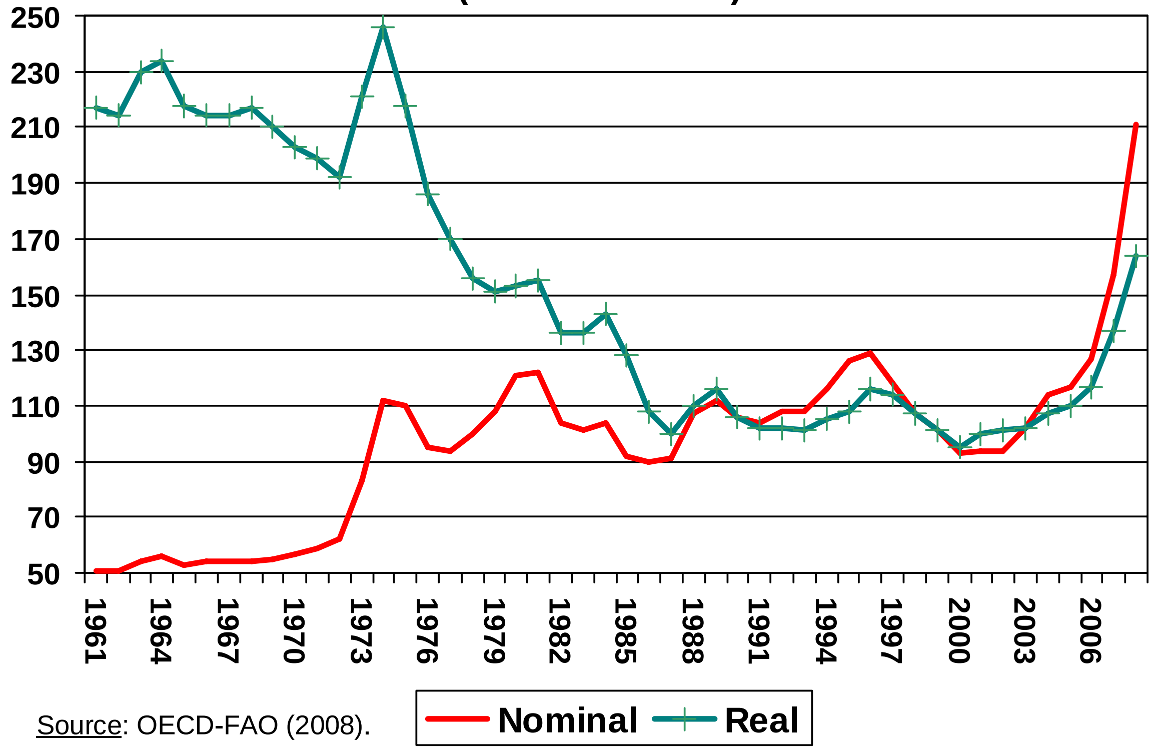
[8] It is unsettling to realize that rich countries subsidized agriculture for decades, depressing world food prices and converting developing country exporters into importers (e.g., Africa in the early 1980s switched to being an importer). After developing countries became vulnerable to food price increases, they were hit with this unexpected shock where the oil price spike triggered biofuel policies to cause an increase in grains and oilseeds prices.

agricultural R&D in developing countries. The development of second generation biofuels is especially key but is uncertain for the moment although much is being invested and so will probably take some pressure off of food crops in fulfilling government policy goals on renewable fuels. The yield gap for sugar cane production is estimated by the FAO (Wiebe 2008) to be 30 percent while the expert Ganesh Kishore argues that if all of the known technology used for corn in the United States was applied to sugar cane in Brazil, sugar cane yields would be 2 to 3 times current levels.[9] Hence, global supply response will inevitably bring current prices down. But the wild cards for the future are the levels of energy prices and potential adverse impacts of global warming on agricultural production.

[9] See video of keynote address at http://www.oardc.ohio-state.edu/nabc20/filevideoview.asp?fileid=598.

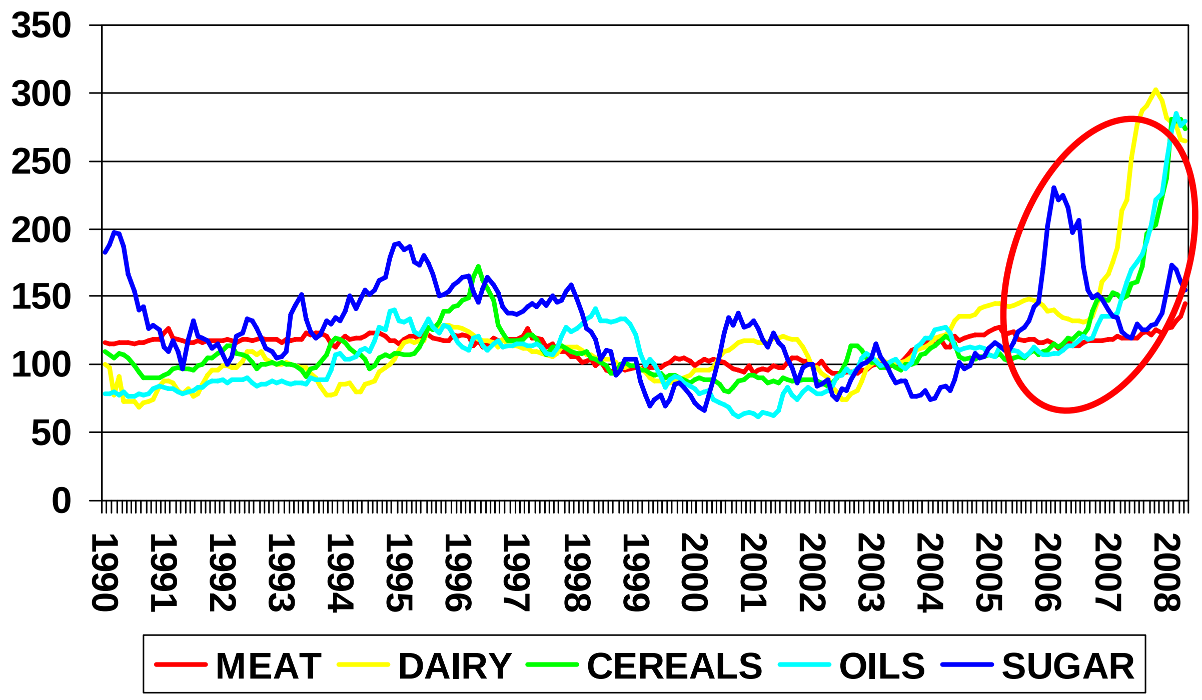
Figure 1: FAO Food Price Index

(1998-2000 = 100)



Source: OECD-FAO (2008).

Figure 2: All agricultural commodity prices have increased over the past two years



Source: Gürkan (2008).

Figure 3: Euro-$ Exchange Rate and Corn Price

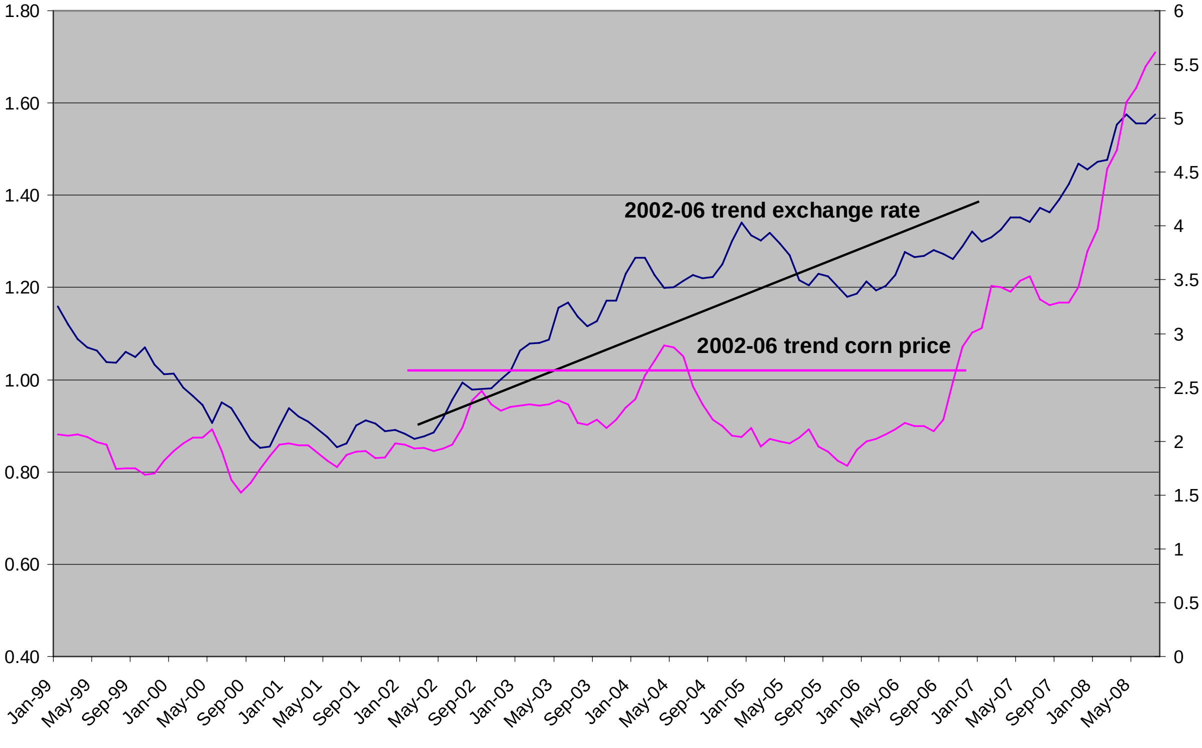
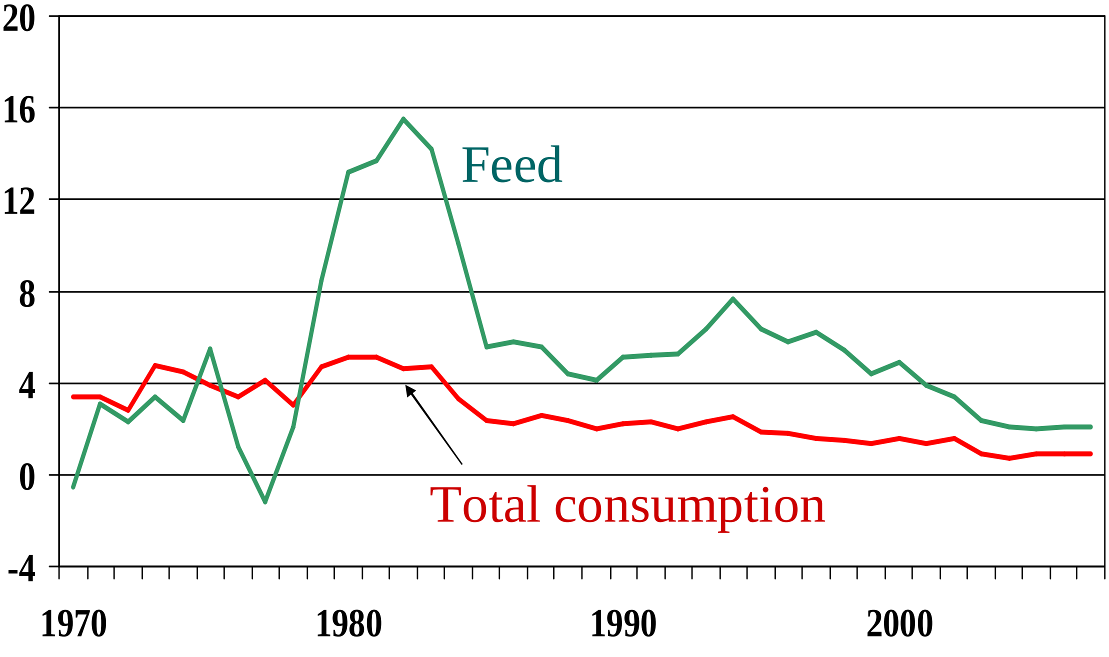


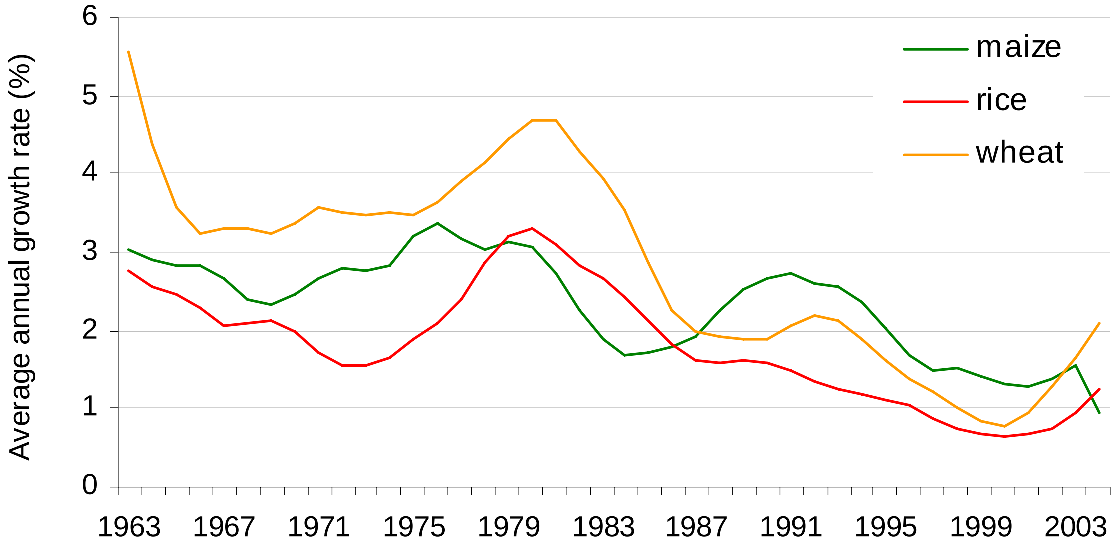
Figure 4: East Asia Grains & Oilseeds Demand

(annual growth rates over 5 years)



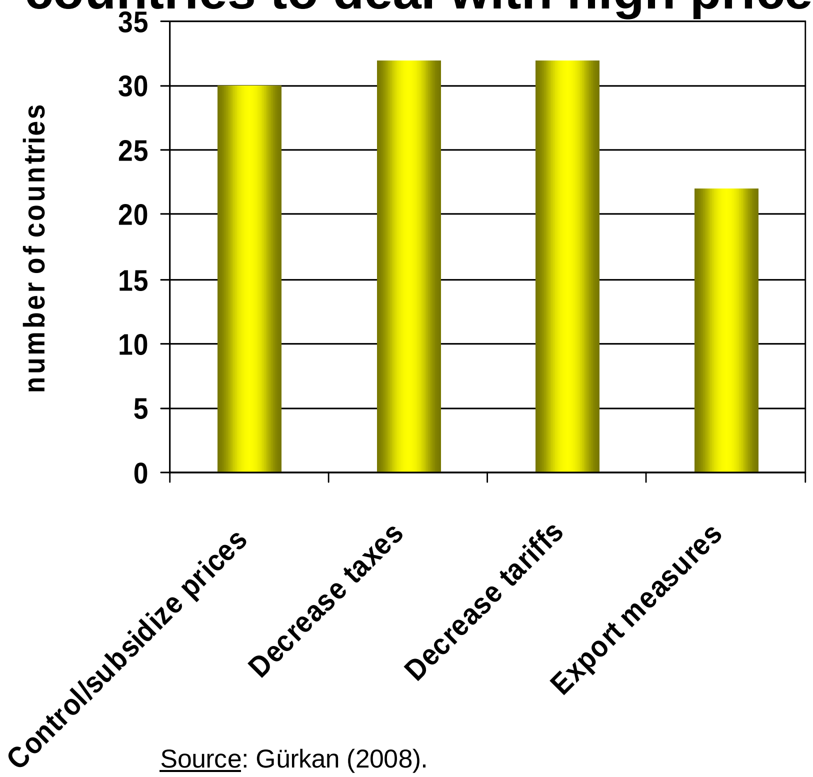
Source: USDA PS&D database processed by Don Mitchell, personal communication.

Figure 5: Growth rates of yields for major cereals are slowing in developing countries



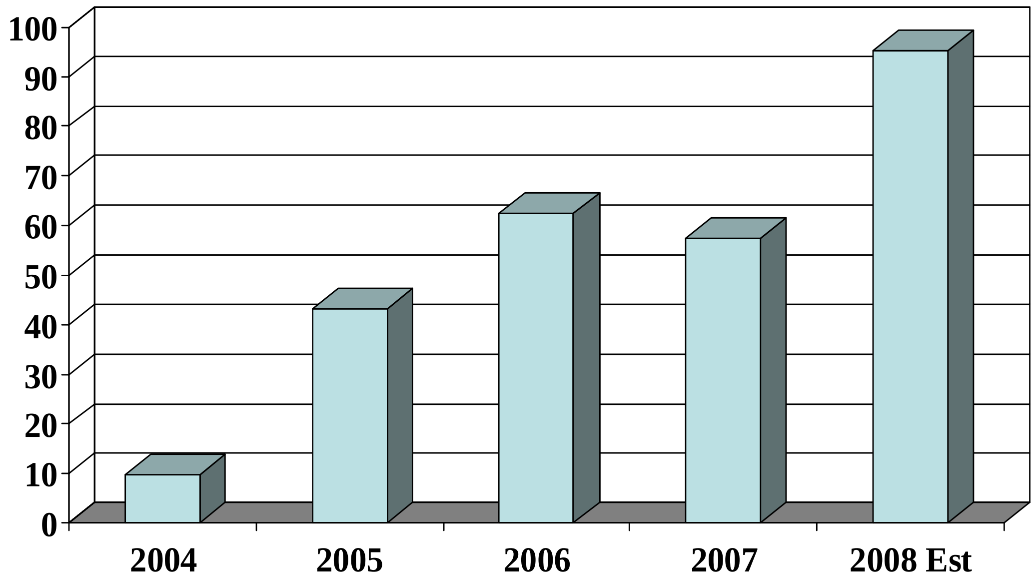
Source: World Bank Development Report (2008).

Figure 6: Policies applied in developing countries to deal with high prices



Source: Gürkan (2008).

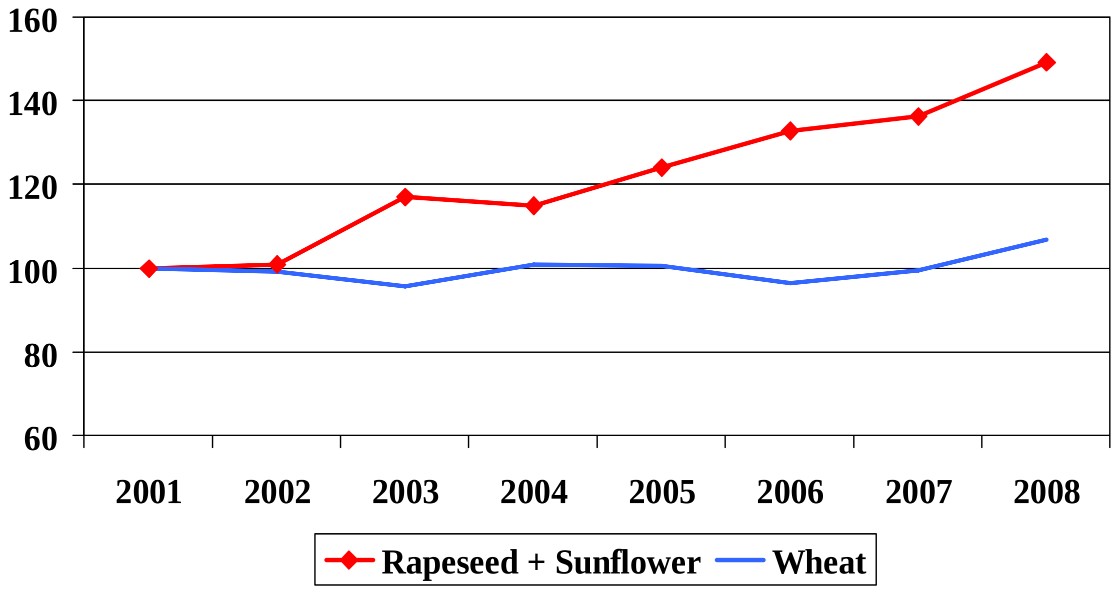
Figure 7: Share of Increase in Global Maize Consumption Going to U.S. Ethanol



Source: USDA PS&D database processed by Don Mitchell, personal communication.

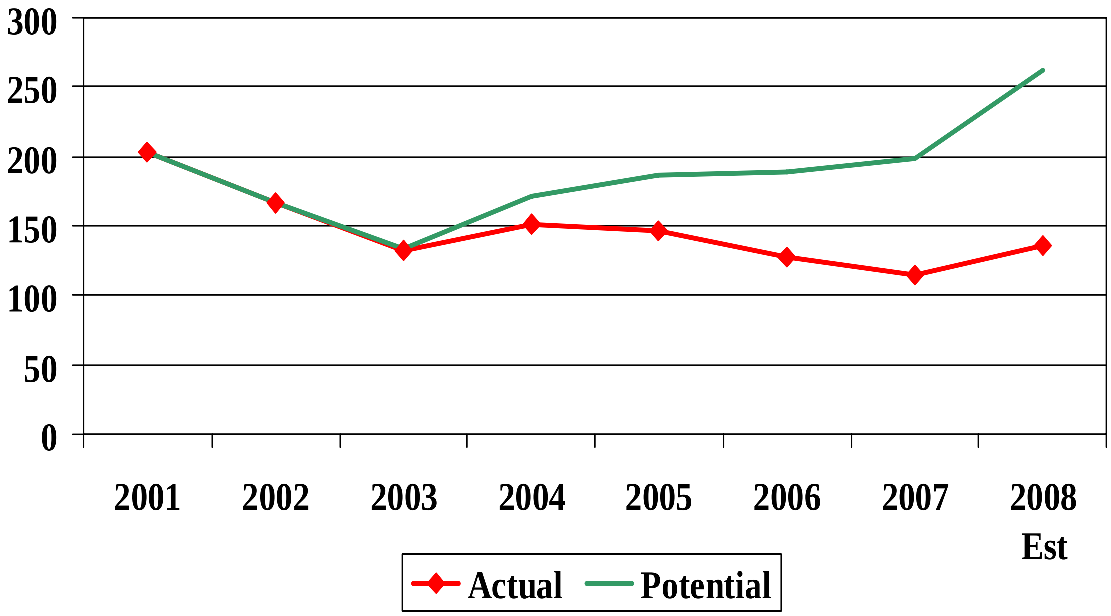
Figure 8: Wheat and Oilseed Area

(relative to 2001 for 8 major wheat exporters)



Source: Mitchell (2008).

Figure 9: Wheat Stocks (million tons)



Source: Mitchell (2008) revised.

Figure 10: Ethanol prices: Actual; tax credit only; or no policy

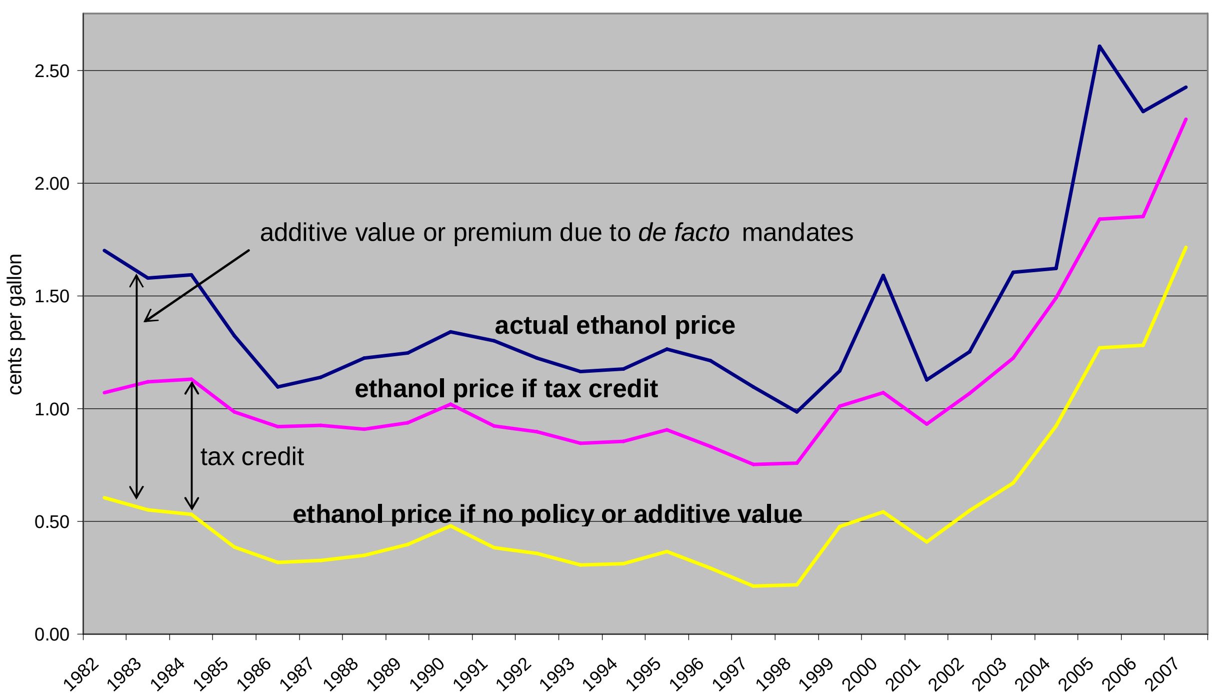


Figure 11: The Effects of a Tax Credit on Corn Prices with "Water"

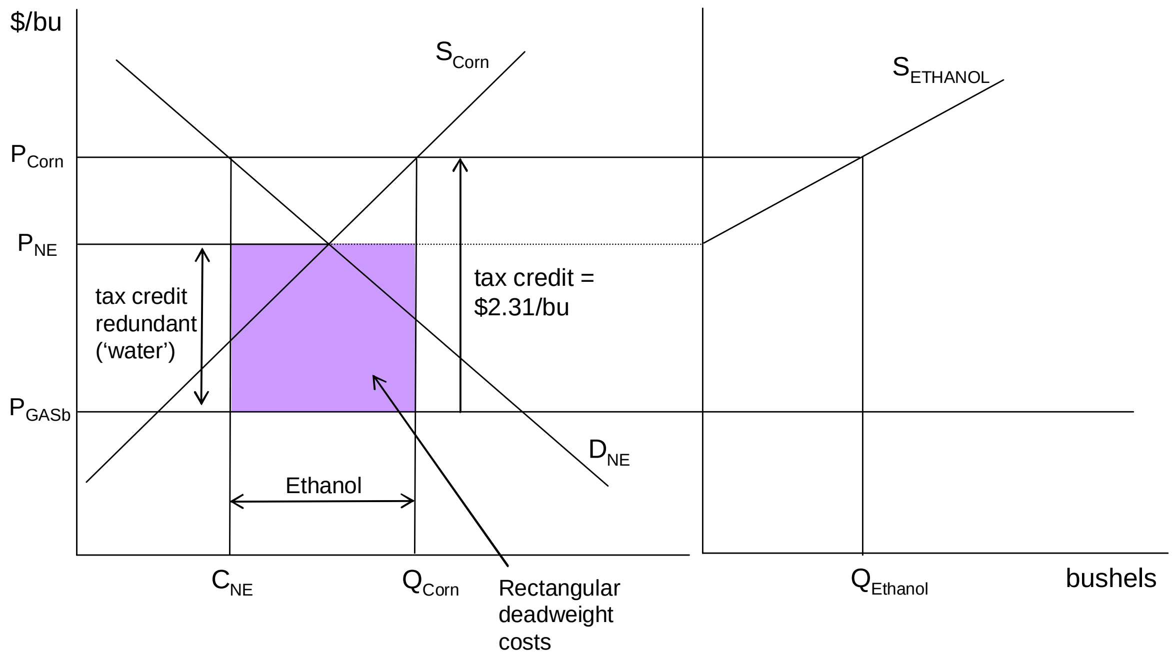
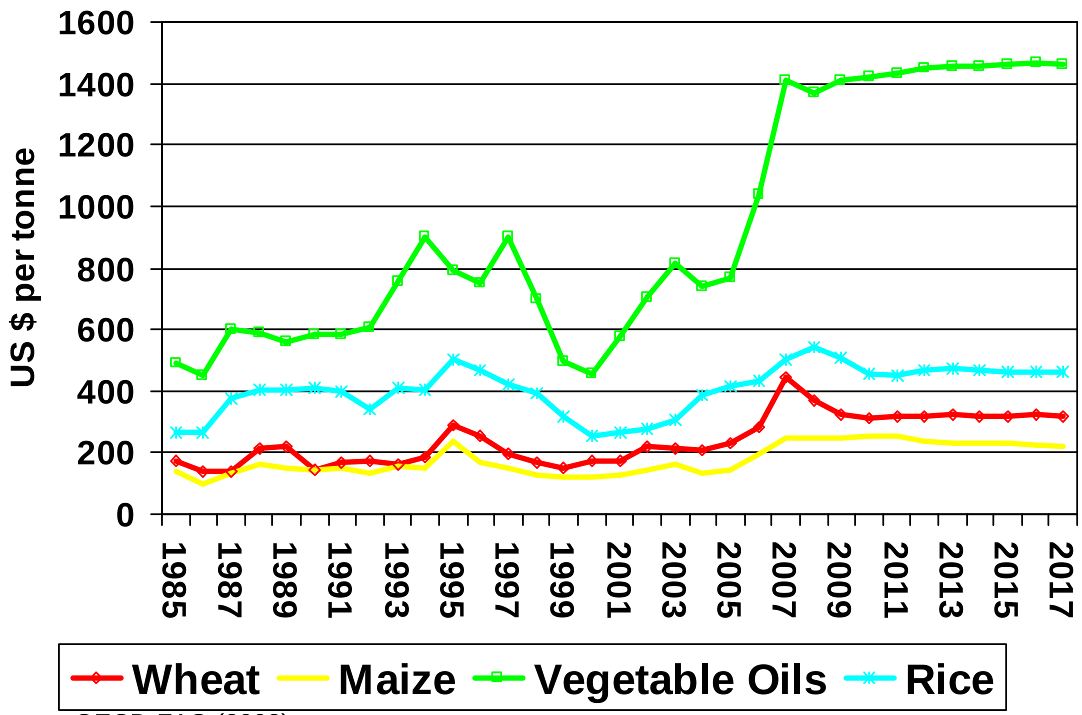


Figure 12: OECD/FAO projections suggest prices of all major food commodities in relative terms will remain high over the next decade...



Source: OECD-FAO (2008).

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